



Northern Rhodesia

Department of Agriculture

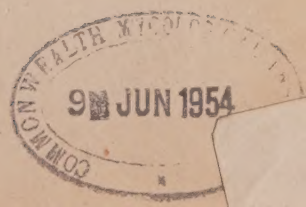
ANNUAL REPORT
for the Year
1953

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African Agricultural Capitaos—66.

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African Agricultural Capitaos—45.

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African Agricultural Capitaos—24.

Department of Agriculture

ANNUAL REPORT FOR THE YEAR 1953

PART I.—AGRICULTURE IN THE TERRITORY

INTRODUCTION

The year 1953 has been eventful for agriculture in Northern Rhodesia. The Federation of the Rhodesias and Nyasaland had immediate repercussions, bringing European agriculture north and south of the Zambezi much closer together, and providing an excuse for political unrest in African areas except Barotseland, which interfered with extension work. Fortunately weather conditions were on the whole favourable and good harvests brought welcome relief to the industry after a series of adverse seasons.

2. The maize crop of over a million bags was a record for the Territory and almost equalled consumption requirements; inability to forecast this crop resulted in the importation of 30,000 tons of maize from Nyasaland at considerable expense. The groundnut crop of 2,800 tons, mostly from the Eastern Province, was also a record.

3. Tobacco farmers enjoyed a better year. More attention was paid to quality and presentation but prices generally were disappointing being below those paid for Southern Rhodesian tobacco grade for grade; the difference was particularly marked in the case of tobacco from the eastern area which was sold over the Salisbury floors for the first time.

4. Shortage of capital, labour difficulties and rising costs generally hamper the development of the European farming industry and the rate of expansion has slowed down considerably; a number of tobacco farmers in the Eastern Province have had to leave their farms. Mr. L. G. Troup, O.B.E., arrived in the Territory in August, 1953, to conduct a Commission of Inquiry into the present and future development of the industry; his report is expected to be available in April, 1954. The Land Bank opened its doors in August, 1953, thus taking over the functions of the Loans Sub-Committee of the Land Board.

5. Despite political disturbances African agriculture on the whole made progress, particularly in the Katete and Petauke areas of the Eastern Province: food supplies were adequate and cash crop surpluses were considerable. Marketing problems have emphasised the need for paying greater attention to economics in production policies, and the rapid development of a cash economy in areas accessible to the railway line stresses the urgency of comprehensive land-use planning.

6. The Natural Resources Board has been active over a wide field, including regional conservation on a watershed basis, the protection of headwaters of major rivers, bush fire control, and the problems raised by the twenty-one Intensive Conservation Committees in European farming areas. A congress of Intensive Conservation Area representatives was held in Lusaka on the 14th October, 1953. A permanent unofficial Chairman, Captain J. Blascheck, from Southern Rhodesia, has been appointed and the Natural Resources Board has taken over the functions of the Central Fire Board.

7. The centenary year provided many opportunities for contacts between the farming industry and the public. A large section of the Northern Rhodesia exhibit at the Centenary Exhibition was devoted to agriculture in its various aspects. Sir Ellis Robins opened the annual show of the Northern Rhodesia Agricultural Society which was held on the permanent showground, Lusaka, on 1st-3rd August. Attendance again broke previous records but entries were fewer than expected. Successful shows in African rural areas were held at Monze, Katete, Mumbwa and Kasama.

8. The Fourth Annual Congress of the Northern Rhodesia Farmers' Union was opened in Lusaka by Mr. J. M. Caldicott, Minister of Agriculture in Southern Rhodesia, on the 20th September, with the President, Mr. W. H. Wroth, O.B.E., in the chair. The main resolution which was carried unanimously reads as follows:

"That it will be in the best interests of European agriculture in Northern Rhodesia for it to be transferred to the Federal Government at the earliest possible date."

The Northern Rhodesia Farmers' Union amalgamated with the Rhodesia National Farmers' Union in Southern Rhodesia during the year.

9. Experience during the year has further emphasised the urgent need for research and investigation to provide a scientific basis for future agricultural development: it is gratifying to record that the chemistry and plant pathology laboratories commenced operations during the year at the Central Research Station near Lusaka, and a Pasture Research Officer and Ecologist took up their duties within the year.

MAJOR CROP REPORTS

Maize

10. In spite of criticism of the price in the previous year, interest in the maize crop by both European and African growers has not diminished with the result that a favourable season produced the record crop of some 1,037,000 bags in the Maize Control Board area of which 55 per cent. was produced by European farmers. The trend of European production is shown in the following table:

MAIZE PRODUCTION ON EUROPEAN FARMS

<i>Season</i>		<i>Acreage planted</i>	<i>Estimated total crop reaped (200 lb. bags)</i>	<i>Estimated bags per acre reaped</i>
1947-48	... ..	65,800	435,000	6.6
1948-49	... ..	74,040	370,500	5.0
1949-50	... ..	105,000	572,000	5.4
1950-51	... ..	98,265	467,000	4.7
1951-52	... ..	98,000	433,500	4.4
1952-53	... ..	105,000	602,343	5.7

11. The prolonged growing season suited the African crop which as usual was late planted. The surplus marketed in the Southern and Central Provinces, 434,768 bags, was a record; the increased production from the Central Province was most marked. The trend of production and the proportionate contribution of European and African crops in the Maize Control Board area are shown in the following table:

MAIZE PRODUCTION FOR SALE IN THE RAILWAY BELT

(Thousands of bags of 200 lb.)

<i>Year</i>		<i>European grown</i>	<i>African grown</i>	<i>Total</i>
1944	... ..	212	115	327
1945	... ..	273	202	475
1946	... ..	268	172	440
1947	... ..	190	54	244
1948	... ..	343	256	639
1949	... ..	283	61	344
1950	... ..	447	344	791
1951	... ..	399	290	689
1952	... ..	389	173	562
1953	... ..	602	435	1,037

12. In the Eastern Province a total of 129,000 bags of maize was marketed through the Eastern Province Agricultural Produce Board; of this, 90,000 bags were exported to the line of rail. With a price of 16s. 6d. per bag, acreages have expanded on the fertile loams of the province and care must be exercised in the future to ensure that maize production does not get out of balance with market requirements; an attractive price for groundnuts and a revival of interest in the Burley tobacco industry around Petauke are important in this regard.

MAIZE MARKETING IN THE EASTERN PROVINCE

<i>Year</i>		<i>Local production</i>	<i>Imports</i>	<i>Total</i>	<i>Exports</i>
1949	... ..	30,500	22,500	53,000	Nil
1950	... ..	48,000	12,000	60,000	Nil
1951	... ..	80,000	Nil	80,000	32,000
1952	... ..	101,000	Nil	101,000	60,000
1953	... ..	129,100	Nil	129,100	95,000

13. Territorial maize consumption which has been rising annually remained steady in 1953 at around 1,100,000 bags; it is apparent that in favourable seasons the Territory can achieve self-sufficiency. Seasons in this part of the world are notoriously fickle which emphasises the importance of Government's storage policy. The opening of the Lusaka 15,000-ton grain silo in May, 1953, was an event of first importance. The increased use of fertilisers, particularly in the form of nitrogenous top dressings, is likely to increase yields in the future and so offset any reduction in acreage brought about by labour shortage. Work proceeds upon the mechanisation of harvesting but lack of uniformity of the crop in the field presents special problems. On African farms various betterment schemes are beginning to affect production and will lead not only to an increase in total yield but, it is hoped, to greater stability as improved techniques reduce the effects of seasonal variation.

14. The controlled price of maize delivered to line of rail depots, which is based upon a hypothetical cost of production formula, was increased in March, 1953, to 40s. 9d. per bag of 200 lb. net weight, exclusive of the cost of the bag. The uniform cash payment at rural depots to African producers in Maize Control Board areas was 27s. 9d.: the difference between this cash payment and the standard price is used to defray marketing costs, the balance being credited to the African Farming Improvement Scheme.

Wheat

15. The production of wheat has dwindled from 2,475 tons in 1946 to such negligible proportions as scarcely to justify mention. Its growing popularity as a food, however, is a matter of some signifi-

cance; importation totals approximately 18,000 tons annually. The price of 70s. per bag has proved attractive to one or two growers using winter irrigation. Trials with summer wheats imported from Kenya have not proved successful. It is unlikely that progress will be made until the services of a plant breeder are available.

Tobacco

16. The general trend of production is shown in the following table:

Season	Flue-cured E.A.	Virginia W.A.	Total	Other Virginia (a)	Burley (a)	Turkish E.A.	W.A.	Total all types
1943-44 ...	2,058,000	240,000	2,298,000	—	54,000	—	80,000	2,432,000†
1944-45 ...	2,207,000	243,000	2,450,000	31,000	85,000	20,000	403,000	2,989,000
1945-46 ...	2,823,000	307,000	3,130,000	43,000	77,000	28,000	1,000,000	4,378,000
1946-47 ...	2,928,600	500,000	3,428,600	83,000	125,000	26,500	1,000,000	4,662,100
1947-48 ...	2,988,000	781,500	3,769,500	*	140,000	—	585,590	4,495,090†
1948-49 ...	4,076,300	1,691,600	5,767,900	*	178,800	—	97,000	6,043,700†
1949-50 ...	3,214,500	2,956,500	6,171,000	42,500	327,100	—	115,330	6,655,930
1950-51 ...	4,413,894	6,262,457	10,676,351	50,000	252,879	—	49,368	11,028,598
1951-52 ...	4,104,669	5,418,723	9,523,392	25,000	124,180	—	50,000	9,722,572
1952-53 ...	3,584,444	6,739,094	10,323,538	*	106,557	—	30,356	10,460,451

NOTE.—(a)=Production confined to Eastern Area.

E.A.=Eastern Area.

W.A.=Western Area.

*=Not obtainable.

†=Incomplete.

(a) Flue-cured Virginia

17. Weather conditions in both the eastern and western areas were unusually favourable and average yields per acre of flue-cured tobacco showed some improvement. The total number of registered growers and the acreage planted dropped by comparison with last year as follows:

Season	Area	Registered growers	Acreage	Production	Average price per lb. d.
1951-52	Western ...	304	16,740	5,419,000	32.25
1952-53	Western ...	267	14,000	6,739,000	34.92
1951-52	Eastern ...	203	11,000	4,220,000	20.71
1952-53	Eastern ...	135	6,200	3,584,000	27.37

As a result of the disastrous prices received in Fort Jameson in 1952, Eastern Area flue-cured tobacco was sold over the Salisbury auction floors in 1953. Average prices received for North-Eastern tobacco were 7d. per lb. less than those for North-Western which in turn were 4d. less than comparable Southern Rhodesian prices for the same grades. Attention has been paid to an alleged undesirable tang in North-Eastern tobacco without establishing its cause or significance. Although prices were generally disappointing to Northern Rhodesia growers it is significant to note that the higher grades commanded good prices at between 60d. and 70d. per lb.; medium and lower grades were hardest hit.

18. The leaf disease caused by the fungus *Alternaria longipes* (Ell. and Ev.) gave less trouble than in 1952, but was nevertheless serious in many areas. A new seedbed disease, caused by a fungus identified as *Colletotrichum tabacum*, appeared around Choma in the Southern Province.

19. The general impression of the industry is that hardening prices combined with rising costs are eliminating inefficient growers. Greater attention is being paid to fertiliser practice and methods of handling and curing which it is recognised are essential to future prosperity. As a follow-up to the goodwill mission which visited Europe in 1952 the North-Western Tobacco Association has appointed a representative on the auction floors with the dual function of interesting buyers in North-Western tobacco and reporting back faults noticed on the floor.

(b) Turkish

20. Production showed a further decline to a total of only 30,356 lb. Labour difficulties have played a part in reducing interest but there are signs of a revival for next year.

(c) Burley

21. The production of Burley tobacco in the Eastern Province has declined from over 300,000 lb. three years ago to 106,557 lb. in 1953 of which European production accounted for 85,861 lb. and African, from around Petauke, for only 20,696. The number of African growers dropped from 1,437 in 1952 to 300 in 1953, mainly because attractive prices have been offered for groundnuts and maize, crops which require less attention than Burley, and through disappointment at recent returns which are considerably reduced by the spread of overhead expenses incurred by the Petauke Co-operative Marketing Union upon a small crop. With the closing of the auction floors in Fort Jameson the crop was sold at Limbe in Nyasaland for the satisfactory average price of 29.56d. per lb. Successful efforts are being made to revive interest in the crop but it is likely to take a number of seasons to get back to the former level of production.

Beans and Cowpeas

22. In spite of keen demand the production of beans of the *Phaseolus* type is comparatively small. Two thousand tons are annually imported for use in labour rations. Cowpeas, mainly African produced, are arousing increased interest at a price of 50s. per bag in the Southern Province, but reports indicate only some 200 tons being marketed.

Groundnuts

23. The main feature of this crop is the phenomenal increase in production by African farmers in the Eastern Province, where over 2,000 tons were produced in the Petauke, Katete, Fort Jameson and Lundazi districts. Production in Balovale, Kabompo and Chizera totalled 750 tons and in Fort Rosebery District 65½ tons. The season was favourable and the price of £50 per ton on line of rail proved attractive. The nuts having been produced, there now appears to be some doubt as to the demand for this valuable food at this price which is difficult to understand since the Territory has imported annually an average of over 1,000 tons of nuts and the equivalent of 2,400 tons of nuts in the form of oil over the last four years, at a value exceeding £70 per ton. The matter is under active consideration.

Rice

24. Rice is a peasant crop in which Barotseland, the Eastern Province and the Luapula-Bangweulu area of the Northern Province are at present mainly interested. The crop has been comparatively recently introduced and its development must still be regarded as exploratory. In Barotseland a surplus of 1,342 bags of paddy was sold by arrangement to Messrs. Susman Bros. and Wulfsohn for processing; 2,034 bags of paddy and 420 bags of native hulled rice were purchased in the Eastern Province by the Petauke Co-operative Marketing Union. The remoteness of producing areas makes it essential to produce only rice of a quality which will command the highest price and efforts are being concentrated upon more suitable varieties and improved production, processing and grading techniques.

Cotton

25. Cotton provides an important source of cash in the Kunda area of the Luangwa Valley of the Eastern Province: total production increased by a third to 99,000 lb. of seed cotton. In addition, some 16,600 lb. of seed cotton was grown by European farmers near Fort Jameson. Five pence per lb. was paid for Grade I seed cotton and 2½d. per lb. for Grade II. The total Eastern Province crop of 116,000 lb. yielded 38,500 lb. of lint which was sold to the Southern Rhodesia Cotton Research and Industry Board, Gatooma. On the line of rail fifty-seven European farmers produced 132,998 lb. of seed cotton by arrangement with Gatooma; the price offered was 10½d. per lb. for Grade I cotton.

Potatoes and Onions

26. Interest continues on the line of rail mainly around Livingstone and Lusaka, and production is increasing. Production is seasonal presenting problems of marketing and storage which have yet to be overcome.

Cassava

27. Exports of cassava meal to Barotseland amounted to 700 tons from Balovale and 300 tons from Kabompo. In Fort Rosebery District 150 tons of cassava meal were purchased by the Co-operative Marketing Union for local distribution. Methods of production of this crop are wasteful and it is preferable that it should be regarded as a subsistence rather than a cash crop.

Sorghum

28. Sorghum is an important subsistence crop in many parts of the country, and the main outlet for a surplus has been through the beer halls on the railway line, where from time to time very attractive prices have been obtained. During 1953 importations from neighbouring territories have been heavier and one or two successful local producers have been left without a market. It is not Government's policy to encourage production of grain sorghum as a cash crop and no price or market is guaranteed.

STATISTICS OF EUROPEAN AGRICULTURE

29. The collection of statistics of European agriculture is carried out annually by the Department of Agriculture on behalf of the Central African Statistical Office. Livestock returns formerly collected by the Veterinary Department were included this year for the first time. The response of the farming community has been poor. A summary of data collected in respect of 1951-52 season shows the following by comparison with 1950-51:

	1950-51	1951-52
Total number of farms	1,099	1,130
Total area of European farms	4,136,156 acres	4,571,668 acres
Total area under cultivation	191,896 acres	190,489 acres
Total area planted in maize	102,185 acres	104,542 acres
Total area green cropped	36,017 acres	29,162 acres
Total area planted in tobacco	22,290 acres	23,806 acres
Total area under irrigation	3,902 acres	3,972 acres
Numbers of cattle	127,387	121,395
Numbers of sheep and goats	6,511	7,061
Numbers of pigs	6,614	7,808

PART II.—THE WORK OF THE DEPARTMENT

GENERAL POLICY

30. The general policy of the department remains unchanged, namely to develop and to stabilise European and African agriculture to ensure as great a degree of self-sufficiency as possible in territorial food requirements, combined with a high permanent level of farming prosperity. In European farming areas the aim is to encourage a higher standard of farming by attention to—

- (i) Sound land-use by planning on a watershed and farm basis.
- (ii) Soil fertility through regular green cropping and the sound use of fertilisers.
- (iii) Soil and water conservation and the use of irrigation.
- (iv) Improvement in the quality and yield of tobacco by concentration upon smaller acreages and better production and handling techniques.
- (v) Diversification of farming enterprise on mixed farming lines to spread the economy away from monoculture in maize and tobacco.

31. In African farming areas the aims are broadly—

- (i) To stabilise the population on the better areas of soil through planned development and the introduction of permanent systems of farming.
- (ii) The protection of natural resources by land-use planning on watersheds, controlled clearing, fire control, contour farming, rotation of crops, mixed farming, rewards for good farming practices, replacement of sledges by carts, development of water supplies, controlled grazing and generally to facilitate the change-over from a subsistence to a cash economy without endangering the soil.
- (iii) To improve living standards by the encouragement of new crops, particularly food cash crops such as rice and groundnuts, which provide a safeguard against famine and a return on development capital.
- (iv) To provide loan capital for development in suitable areas under control of the native authorities.

STAFF AND ORGANISATION

32. The administration and extension branches of the department continue to be organised on a territorial basis corresponding with the main political subdivisions of the country. A small head-quarter staff is maintained in Lusaka consisting of the Director, Deputy Director, Chief Agricultural Officer, Chief Conservation Officer and Chief Tobacco Adviser, together with clerical and accounting staff. The main body of the general agricultural staff consists of one Chief Agricultural Officer, thirteen Agricultural Officers, forty-four Agricultural Supervisors, 184 African Agricultural Assistants, 319 Agricultural Capitaos and seventy-nine Agricultural Messengers, distributed throughout the six main provinces of the Territory as shown in the Staff List at the beginning of this report. Vacancies exist for nine Agricultural Officers for which three are undergoing post-graduate training, and vacancies exist for seven Agricultural Supervisors. The staff position has improved during the year but the shortage of Agricultural Officers is still acute making it difficult to fulfil commitments in European and African areas and imposing particularly heavy strain upon officers in charge of provinces.

33. Specialist services available during the year consisted of—

- (a) Central Research Station, Mount Makulu: Senior Agricultural Officer (Irrigation), Agricultural Chemist, Soil Scientist, Plant Pathologist, Pasture Research Officer, Ecologist. The Plant Pathologist joined the staff at the beginning of the year, the Pasture Research Officer took up his duties in February, 1953, and the Ecologist in December. Two plant breeders are expected in 1954. The appointment of a Chief Research Officer is now urgently required; in his absence the Deputy Director has been co-ordinating the work of the specialist staff.
- (b) Conservation Service: Chief Conservation Officer, seven Conservation Officers, eight Agricultural Supervisors (Conservation) together with workshop, maintenance and clerical staff. A vacancy existed for only one Conservation Officer at the close of the year. There is need now for an increase in this staff.
- (c) Tobacco Advisory Service: Chief Tobacco Adviser, four Assistant Tobacco Advisers and two Agricultural Supervisors in charge of experiment stations at Choma and Fort Jameson. Specialist staff work through the provincial organisation as far as possible.

Staff Changes

34. There have been no major staff changes during the year. Additions to the department have consisted of two Agricultural Officers, F. Durocher-Yvon, M.B.E., on transfer from the Seychelles, and R. N. Coster on transfer from Fiji; three specialist officers, E. A. Riley, Plant Pathologist from Southern Rhodesia, J. H. Hinds, Pasture Research Officer on transfer from the Gold Coast, and N. R. Brockington, Ecologist, on first appointment; two Conservation Officers, Mr. B. W. R. Wilson and B. H. R. Christie; one Assistant Tobacco Adviser, Mr. T. F. O'Callaghan. Ten Agricultural Supervisors were appointed—Messrs. N. D. Thomas, W. C. Verboom, J. S. D. M. Johnstone, R. F. Chambers, I. G. Taylor, M. de la Harpe, F. R. T. Hyam, S. W. Adamson, G. B. Emslie and R. Simms. Two Agricultural Supervisors left the service—Mrs. E. Gabriel and Mr. J. M. Robertson.

SERVICES FOR EUROPEAN FARMING

35. Whilst it has not been possible to provide a comprehensive extension service for European farmers, a fair cover has been achieved by senior officers in charge of provinces, with assistance from Specialist Officers, Conservation Officers and Assistant Tobacco Advisers. Many contacts have also

been made direct from headquarters; this applies particularly to the Deputy Director, the Chief Tobacco Adviser, the Chief Conservation Officer and the Senior Agricultural Officer (Irrigation). A Senior Agricultural Officer on retirement in the Mkushi Block has provided part-time services for farmers in that area. The co-operation of Land Settlement Officers is gratefully acknowledged. All requests for assistance have been met but it has not been possible to take the initiative in extension and conservation as the department would like and knows to be necessary.

36. Tobacco farmers in the Territory have been better served than ever before. Assistant Tobacco Advisers now operate in the Eastern Province with headquarters at Fort Jameson, in the Southern Province with headquarters at Choma and in the Lusaka and Broken Hill areas of the Central Province. This work is co-ordinated by the Chief Tobacco Adviser who himself devotes a large proportion of his time to advisory duties.

37. Mount Makulu Research Station, Chalimbana Government Farm, Kambowa Sub-tropical Fruit and Agricultural Station, and the two Agricultural Stations specialising in tobacco—Mochipapa near Choma and Msekera near Fort Jameson, have been visited to an increasing extent by farmers informally and on organised field days.

38. European agriculture is also served by representation upon a number of boards and committees. The Director of Agriculture is a member of the Land Board and its sub-committees, the Natural Resources Board and the Maize Control Board. He is Chairman of the Western Tobacco Board. He was also a member of the Interterritorial Working Party set up in October to discuss agriculture in the Federation. On the Copperbelt the Chief Agricultural Officer, Ndola, is the Chairman of the Copperbelt Land Alienation Screening and Advisory Committee, which has performed outstanding service during the year. The Provincial Agricultural Officer, Fort Jameson, is a member of the Eastern Tobacco Board and also of the Eastern Province Agricultural Produce Board.

39. Close contacts have been maintained with farmers' associations, notably the Northern Rhodesia Farmers' Union, the Northern Rhodesian Agricultural Society, the North-Western Tobacco Association and the North-Eastern Rhodesia Agricultural Association. The department provided secretarial facilities for the Commission of Inquiry into the development of European agriculture; this has occupied the full-time services of a Chief Agricultural Officer from the beginning of August.

40. The Conservation Service devotes its attention almost exclusively to European farming areas. In spite of the economic difficulties of the industry, requests for assistance have far outrun resources. Staff and equipment were distributed in provinces as follows:

A.—Central Province:

One Conservation Officer in charge for eight months.

One Agricultural Supervisor (Conservation) for eight months engaged on planning.

(i) Broken Hill—Chisamba area: two Agricultural Supervisors (Conservation) for eight months of the year with two mechanical units consisting of two D.8 Caterpillar tractors, four D.7 tractors and equipment.

(ii) Lusaka—Kafue area: Conservation officer for three months with one mechanical unit consisting of two VR. 180 tractors and equipment.

B.—Southern Province:

One Conservation Officer engaged on planning.

(i) Mazabuka—Magoye—Monze area: One Conservation Officer, two Agricultural Supervisors (Conservation) of whom one was available for four months, with three D.7 tractors for six months, one D.7 tractor for six months and one D.4 with Nega Nega Intensive Conservation Area.

(ii) Choma—Kalomo—Livingstone area: One Conservation Officer at the close of the year, one Agricultural Supervisor (Conservation); equipment consisted of one motorised grader and one D.6 for part of the year, and the Choma Intensive Conservation Area unit of three Fordson tractors and scrapers.

(iii) Upper Kaleya Regional Pilot Scheme: One Conservation Officer with one unit consisting of two D.7 tractors for half the year.

C.—Eastern Province:

One Agricultural Supervisor from July.

41. The following is a summary of the work carried out by the Conservation Section on European farms during 1953 in each province shown by comparison with the totals for the previous year:

CONSERVATION WORKS

Operation	Central Province	Southern Province	Total 1953	Total 1952
Contouring by farmers ...	—	3,000 acres	3,000 acres	1,358 acres
Storm drains	6,900 yards	20,750 yards	27,650 yards*	31,038 yards
Buffer dams	—	—	—	70
Contour ridges	13,266 yards	123,220 yards	136,486 yards *	62,190 yards
Waterway guide banks ...	—	10,100 yards	10,100 yards	11,480 yards
Fence lines and fireguards ...	41 miles	42.4 miles	83.4 miles	17 miles
Roads	5½ miles	5 miles	10½ miles	2 miles
Subsoiling	—	—	—	304 acres
Bush clearing	3,042 acres	872 acres	3,914 acres	1,305 acres
Windrowing	373 acres	—	373 acres	35 acres
Dams	—	9	9†	9
Capacity... ..	—	22,000,000 galls.	22,000,000 galls.	30,500,000 galls.
Ponds and tanks	—	—	—	12

* Excludes 31,407 yards of storm drain and 60,400 yards of contour ridge on pilot scheme Mapangazia.

† Dams constructed by I.C.A. units at Nega Nega and Choma.

It will be noted that the above figures show a considerable increase in works accomplished. In addition, repairs to previously constructed dams in the Broken Hill area cost 430 tractor hours; greater attention is now being paid to the size of catchment in relation to the nature of the material from which the spillways are constructed.

42. In the Eastern Province no Conservation Officer has been available but an Agricultural Supervisor was put onto conservation work in July, and after a slow start requests for assistance were received from twenty-seven estates and five missions. One thousand three hundred and sixty-five yards of storm drains were pegged and 116,000 yards of contour ridges protecting 1,020 acres.

43. An important change in policy has been introduced during the year, namely a distinction between works of a regional nature and farm conservation: this policy will be given full effect in 1954. Regional works are planned comprehensively by a planning team on a selected watershed basis regardless of ownership boundaries; the bulk of the heavy equipment will in future be used on this work which will qualify for a considerable subsidy from Government. Complementary with regional planning will be farm planning within the main framework: this detailed work will be carried out mainly by farmers with their own Intensive Conservation Committee equipment under the guidance of district Conservation Officers and Assistants. By this new approach it is hoped to secure the orderly protection of the country as economically as possible.

44. Financial losses incurred in the operation of heavy equipment have continued to exercise Government and authority was obtained late in the year to increase tractor charges as follows:

D.6 increased from £2 15s. per hour to £3 13s. 4d.

D.7 increased from £3 10s. per hour to £4 13s. 4d.

D.8 increased from £4 5s. per hour to £5 13s. 4d.

These charges are based upon previous experience in the cost of operating conservation machinery; they assume 1,200 hours' operation annually per tractor and include workshop charges and depreciation. The accounts in respect of 1953 are not available but tractor hours worked by the fifteen tractors in operation total only 15,003 instead of 18,000 expected, due to unavoidable delays in overhauls and repairs. It is hoped to improve upon this performance in 1954 by concentrating equipment and supervision on regional works.

45. The collection of revenue for works carried out has left much to be desired and involved the department in extra paper work. At the close of the year £18,000 was overdue for works carried out prior to 1953. The long-term loan scheme for planned conservation works at present under consideration by Government should prove of great assistance in the future. Meantime pressure is being maintained to secure early recovery of outstanding debts.

SERVICES FOR AFRICAN FARMING

46. There have been no radical changes in policy during the year but a slight improvement in the staff position has allowed a greater concentration in certain areas and all stations have been maintained in spite of leave incidence and resignations. The work of the extension staff is concerned largely with conservation and the expansion of betterment schemes such as the African Farming Improvement Scheme, the Peasant Farming Scheme and the control of shifting cultivation or "chitemene" as it is known locally. Attention is also paid to school gardens and farms and staff training. The main immediate need now is for more professional officers to plan the next steps in advancement. Good progress can be recorded in major programmes of extension and a considerable improvement in African staff housing through the implementation of the Development Plan for extension in African areas.

47. Thirty-two agricultural stations provide extension bases as follows:

Southern Province	...	Monze, Magoye, Mapangazia, Kanchomba, Mapanza, Gwembe.
Central Province	...	Broken Hill, Muswishi, Chiwefwe, Serenje, Keembe, Mumbwa, Shibuyunji (Sala), Chalimbana.
Eastern Province	...	Fort Jameson, Lundazi, Kalichero, Chadiza, Katete, Petauke.
Western Province	...	Ndola, Kambowa.
North-Western Province	...	Kasempa, Kabompo.
Northern Province	...	Kasama, Lunzuwa, Isoka (Old Fife), Luwingu, Fort Rosebery, Kawambwa, Samfya.
Barotseland	...	Namushakende.

In addition to the above there are a number of African Agricultural Assistants posted to extension centres away from agricultural stations. The continued outstanding work of Richard Nyirenda, B.E.M., in charge of the Keembe Centre is deserving of special mention.

Conservation

48. Conservation is closely integrated with agricultural extension in African farming areas. Perhaps because of its intimate connection with land, conservation work has come in for an undue share of attention from political agitators, particularly in parts of the Eastern Province; but from the viewpoint of the welfare of the African it would have been difficult to find a more unfortunate or more irresponsible way for them to use their influence. It must also not be overlooked that in many areas the Department of Agriculture is a comparative newcomer and it has been suggested that the department has been trying to go too fast with the result that the people are tired not necessarily of conservation, but of being continually "chivvied" and being sent to court for petty offences. There is undoubtedly much truth in this allegation: when staff is thin on the ground short cuts are sought in place of what should be a steady educational process. In spite of such difficulties progress has been made; the position in each province is outlined below.

SOUTHERN PROVINCE

49. The outstanding need in this province is for the development of a sound balance between grazing lands and arable lands, coupled with the better use of both for greater production. The problems of destocking and land planning will unquestionably be difficult because they will need the goodwill of the people for success, a commodity which appears to be sadly lacking at the present time.

50. The pilot conservation scheme on the headwaters of the Kaleya River at Mapangazia in Chief Mwenda's country has progressed to the stage where heavy mechanical works are almost complete. It now remains to establish paddocks on the central grazing area which cannot be effected until arrangements are complete for the accommodation of the people, some sixty families, who must be moved to a residential site. The reclamation of this badly eroded area covering 7,815 acres has involved the following constructions which have been carried out by the Conservation Section of the department in 2,700 tractor hours at a total cost of £9,558 or £1 4s. 6d. per acre:

Storm drains	...	...	33,677 yards
Contour banks	...	...	82,693 yards
Roads	...	...	2 miles
Buffer dams	...	...	24
Conservation dams	...	...	1 (capacity four million gallons)

The works in this area are impressive. It is essential that sound farming should now be followed within the area; otherwise much of the value of the work will be lost. This will be a matter on which the field staff will concentrate in the future. The enormous cost of reclamation when a situation is allowed to deteriorate should give food for thought to those responsible for land and people. It should perhaps be emphasised that it is only the high inherent quality of the soils in the Upper Kaleya area which justifies expenditure on this scale.

51. Fourteen Ferguson tractors with mid-mounted disc terracers have operated in the province during the year making 340 miles of contour ridge and seven dams of total capacity of twenty million gallons; in addition three dams and two weirs made previously were repaired; thirty-six miles of grass filter strips have been demarcated in arable lands and twenty-four miles of cultivation boundaries along rivers have been marked; five masonry weirs have been constructed.

52. Population pressure is becoming acute in the Kanchomba and Macha areas and cultivators are being forced into the hills where the land is too steep for normal cultivation. Eight miles of hand-made graded contour banks have been constructed at a cost of 8d. per yard showing a total cost of £3 per acre. The ploughing and denuding of steep hillsides particularly in the Moyo area is proceeding apace but so far the native authorities have been unwilling to co-operate in conservation measures.

CENTRAL PROVINCE

53. In the Keembe and south-west Broken Hill areas some twenty miles of contour ridging have been carried out; further north in Chief Chipepo's country grass strips have been demarcated in Improved Farmers' lands. Contour ridges have been constructed in the Soli Reserve mostly on Improved Farmers' lands and in the Sala Reserve it is estimated that 1,822 acres of scattered arable lands have been protected with nine miles of ridging. At Mumbwa, Serenje and Mkushi, work has been confined to the protection of improved and peasant farms. At Keembe, where water supplies are difficult, a T-dam has been made with a Ferguson tractor and dump scraper. A stone weir has been constructed to serve the Lumpampa farms in the Serenje District.

EASTERN PROVINCE

54. Political difficulties in Ngoni areas near Fort Jameson, the Mumbi District of Petauke and among the people of Kathumba and Mbang'ombe of Katete have slowed up the progress of conservation work and in some places contour banks have been deliberately broken. The position showed signs of considerable improvement by the close of the year. Efforts to encourage the use of farmyard manure in the crowded Ngoni and Chewa Reserves have so far met with little response. Elsewhere in the province good progress has been made. The following table sets out the position:

African Cultivated Land under Contour Cultivation in the Eastern Province, 1953

			No. of villages 1953	Estimated acreage protected	Total villages protected to date	Total acreage
Fort Jameson:						
	Katete	...	40	5,000	630	90,000
	Kalichero	...	58	6,583	427	67,000
	Chadiza	...	99	12,500	471	76,500
	Petauke	...	30	3,500	760	115,000
	Lundazi	...	210	21,942	676	80,822
			<u>437</u>	<u>49,525</u>	<u>2,964</u>	<u>429,322</u>

WESTERN AND NORTH-WESTERN PROVINCES

55. Practically the whole of these provinces constitutes an important territorial watershed. Population is relatively sparse and by far the most important conservation measure is the protective early burning of the woodland. Attention is being paid to the control of cultivation on river banks and dambos. The combined Administrative, Forestry and Agricultural Survey of the Kafue Head-water Area in the Solwezi District was completed during the year and a comprehensive report was submitted to the North-Western Provincial Team in September. Early action is being taken to implement the findings of the survey within the limitations of staff available.

NORTHERN PROVINCE

56. Some 315 miles of contour ridging have been demarcated in cultivated areas throughout the province. Special attention has been paid to early burning with success. An investigation of the headwaters of the Luangwa River was carried on in July. The indications are that the area can be adequately protected by introducing sound farming methods and African extension staff have been posted for the purpose. Irrigation furrows have been pegged as required in Mporokoso, Kasama, Abercorn and Chinsali districts.

BAROTSELAND

57. A small amount of contour ridging has been demarcated at Mankoya and a campaign has been started for grass planting in school compound areas. Assistance has been given with the "sishanjo" drainage at Kasabi and the construction of the Lukalanya canal. Drainage is vital to the exploitation of the fertile "sishanjo" soils and because of the difficulty in carrying out this operation satisfactorily with communal labour an important decision has been taken by the native authority to use organised paid labour in the future.

African Farming Improvement Schemes

58. Two schemes are in operation which arise from betterment funds created by the marketing of the African maize crop: the original scheme applies to the Maize Control Board Area of the Southern and Central Provinces; in 1953 a scheme on somewhat similar lines was started in the Eastern Province.

59. The fund in the Maize Control Board area arises from the difference between the price for maize paid to the African producer at rural depots, plus transport and buying costs, and the standard producer price negotiated on the basis of the hypothetical European cost of production for maize delivered to line of rail depots. The committee appointed to administer the fund consists of the Provincial Commissioners, Southern and Central Provinces, the Commissioner for Native Development, the Manager of the Maize Control Board and four African members, Mr. William Kasoka and Chief Chona from the Southern Province, and Mr. George Shipekwa and Mr. Andrew Munanyinda from the Central Province, with the Director of Agriculture as chairman. The committee advises Government upon the price to be paid to the African producer for African maize and controls the policy of the scheme. The main purpose of the committee is to ensure that as far as possible revenue is spent proportionately in the areas of production upon such works of benefit to the producer as will enable him to approach the high permanent level of farming envisaged in the formula upon which the price of maize is calculated. To this end acreage bonuses are given to registered improved farmers, that is farmers who rotate their crops and practise green manuring and composting and apply fertilisers; subsidies are given for fertilisers and the purchase of carts; loans on a limited scale are available for the purchase of approved implements such as ridging ploughs and planters; and considerable sums are spent upon soil and water conservation works, lesser amounts on farm roads and the erection of covered sheds or concrete platforms at rural buying depots.

60. Revenue is related to the size of the African crop and, since the cost of the buying organisation remains roughly the same, a small crop reduces unduly the return. Thus the 1952 crop of 178,953 bags produced only £24,482 revenue, whilst the expected revenue from the bumper 1953 crop of 434,768 bags is estimated to exceed £163,000. Expenditure during the year amounted to £130,000. The estimated carry-over at the end of the year was £239,000 and estimates of expenditure approved for 1954 total £129,950. As from the beginning of 1954 a system of commercial accounting will be introduced to replace the Government system; it is considered that commercial accounting methods will be better suited to the requirements of the committee.

61. The number of registered improved farmers has shown only a slight increase in 1953 due to a reduction in numbers in the Southern Province offset by an increase in the Central Province. The trend is shown in the following figures:

	1950	1951	1952	1953	1954
Registered farmers ...	262	455	756	824	905
Bonus paid ...	£3,480	£6,515	£13,157	£15,040	—

Improved farmers' crops are everywhere outstanding and the widespread demonstration of sound farming practice is one of the greatest values of the scheme. It is noticeable that surrounding farmers, though not up to registration standard, are considerably influenced by the example. A total of 470 subsidised carts were sold and 4,380 pockets of subsidised fertiliser. In addition, considerable quantities of legume were distributed on a replacement basis.

62. The difficulty of providing adequate supervision for individual farmers in the field continues to be a limiting factor and it is hoped later to develop improved farming communities, possibly on a co-operative basis, where the bulk of the farmers follow approved practices and qualify for the full maize price less only marketing and transport costs. Such a group would have to balance and manage its grazing land and control stocking as well as conforming with the arable requirements.

63. The Eastern Province African Farming Improvement Scheme arises from a levy of 2s. 6d. per bag on maize purchased by the Eastern Province Agricultural Produce Board. The carry-over from 1952 was £26,928 and the estimated revenue for 1953 was £15,125. Expenditure during the year amounted to £8,438, all aimed at encouraging sound conservation farming. Funds are used to subsidise locally made ox carts, the use of farmyard manure, the construction of approved cattle sheds and the purchase of ridging ploughs. In addition, expenditure is incurred on soil conservation works and seed issues; loans are given for stumping and the purchase of small groundnut shellers.

Peasant Farming Scheme

64. Encouraging progress has been made with the Peasant Farming Scheme particularly in the Eastern Province. Under this scheme capital loans are provided from development funds to enable progressive Africans to establish themselves under direction as cash crop farmers settled either in

groups or on their own individual holdings. It has now been shown beyond doubt that where soil conditions are favourable and access to markets is satisfactory this scheme represents one of the finest ways of developing African agriculture. The Provincial Administration is responsible for the administrative side of the scheme and the Department of Agriculture for the technical work in the field. It is gratifying to record the confidence of Her Majesty's Government in generously providing Colonial Development and Welfare Loan Funds to the extent of £240,000 on a revolving basis to finance a scheme of expansion which was devised by the Deputy Director and received the strong support of the Commissioner for Native Development. This financial provision will enable the programme to go ahead to the limit of staff capabilities for as far into the future as we are permitted to see. Developments are outlined below, province by province.

CENTRAL PROVINCE

65. There are over 100 peasant farmers established in the province, fifty-eight are settled in seven groups in Serenje; the balance are in new groups at Chiwefwe, Mumbwa, Keembe and Muswishi. The Serenje peasant farmers had a more successful year than in 1952 with an average income of £16 after satisfying domestic food requirements. Loan repayments are satisfactory on the whole. In the Sasa block, where soil conditions are above the average, all implement loans have been paid off and a good proportion of the clearing costs. Forty-four additional farms have been cleared in readiness for occupation in 1954.

EASTERN PROVINCE

66. It is in this province that most headway in peasant farming has been made and here the scheme can be seen in operation at its best. Maize and groundnuts are the main crops produced for sale; yields were good in 1953 and markets assured. Incomes per farm varied from £64 to £192 per family in the groups of three years' standing. Numbers in Katete have increased from thirty-nine to sixty during the year, in Petauke from sixteen to thirty-three, in Kalichero from ten to thirteen, and remained at ten in Chadiza. A total of 116 farmers in eleven groups were in occupation by the close of the year. The rate of repayment of loans is highly satisfactory, being well ahead of expectation on a ten-year basis. Three farmers have completely paid off their loans already.

67. An important development in the Eastern Province is the number of individual farmers who have joined the scheme—they have increased from ten to fifty during the past year. These farmers allow their land to be subdivided and agree to follow the five-course peasant farming rotation in return for capital assistance. In suitable circumstances these individuals tend to become the nuclei of informal peasant farming groups. It has been found that the optimum size of holding is fifteen acres under cultivation: attention is being given in planning to ensure in addition adequate grazing lands and woodlots and an expansion area in case the present rotation fails to maintain fertility.

WESTERN PROVINCE

68. Seven families from Southern Rhodesia have been settled in a group at Nyenyanzi in Ndola Rural District: farms of sixteen acres have been laid down on a five-course crop rotation including one green manure crop and the use of compost.

NORTHERN PROVINCE

69. Four peasant farm groups have been established in the province, at Mwambala near Abercorn, Ngulula in Kasama District, Mushota east of Kawambwa and Ndoba east of Fort Rosebery. For some time to come these settlements must be regarded as exploratory: that they represent a great advance upon the indigenous system of farming is undoubted, but there are many problems pertaining to marketing and the maintenance of soil fertility which need clarification before expansion and the investing of further capital can be recommended.

70. Some success is being achieved in the Luapula Valley and in other parts of the province with influencing individual farmers to adopt and to demonstrate more stable farming methods with a view to production in excess of subsistence requirements. In the Luapula Valley in particular this development ties in satisfactorily with the food requirements of the fishing industry.

"Chitemene" Control

71. The annual demarcation of village woodland in the Abercorn, Mporokoso and Isoka districts for shifting cultivation has continued; it is reported that the hoe is now tending to replace the axe.

Corridor Settlement

72. In Kasempa District two interesting settlements have been established at Njenga and at Ingwe. Fifty-six families have now been settled and plans are in hand to settle a further sixty-seven families in 1954. The purpose is to concentrate scattered villagers in selected accessible areas where soil conditions and water supplies have been proved. Provision is made for each family to have five acres under cultivation in each year and twenty acres recuperating in bush fallow. Clearing is conducted progressively in orderly corridors according to a carefully prepared plan. Two similar settlements are being developed in Kabompo District, at Kabulamema Mission Station and at Chifue, and both schemes are in their infancy. The strength of the corridor system lies in the fact that it represents an orderly adaptation of the indigenous farming system and the advantage is that it concentrates the population in selected areas where social services can be provided.

School Farms and Gardens

73. In all provinces attention is given to encouraging school farms and gardens on sound lines. Too frequently agriculture is presented as a dull subject associated with unrelieved drudgery. Close contact is maintained with the Department of African Education and it is agreed that the key to

success is the training of selected teachers in agriculture. Senga Training School in the Northern Province is being adapted for this purpose and enlargements are projected at the Monze Agricultural Training Centre to serve line of rail schools. In the Southern Province a number of school farms follow the improved farming rotation and qualify for bonus. Thirty-nine school gardens are regularly visited by district staff in the Central Province. In the Northern Province, sixty-four schools are regularly visited and a successful school farm competition was organised for the second year. In Barotseland special attention is paid to the subject, fifteen gardens are supervised and it is planned to open a school farm at the Mankoya Native Authority School next year.

AGRICULTURAL EDUCATION—AFRICAN

74. The department started the year with three Agricultural Training Centres giving formal courses for African Agricultural Assistants, School Teachers, Native Authority Councillors and Agricultural Capitaos; these centres are located at Monze in the Southern Province, Katete in the Eastern Province and Lunzuwa in the Northern Province. Due mainly to the difficulty in obtaining sufficient students it was decided to close down the Katete school when the third course was completed in May; nine first-year students in the fourth course were transferred to Monze in October, together with ten new students. The Health Department has been able to use the premises at Katete for a hygiene school and it is hoped that this will become a permanent arrangement. Apart from the inadequate intake of pupils to justify three training centres, at none has it been possible to achieve the level of staffing, namely an Agricultural Officer and an Agricultural Supervisor, as envisaged in the original plan. It seemed wise therefore to concentrate the teaching and such staff as has been available in two centres, one at Monze to serve cash crop areas, the other at Lunzuwa to serve subsistence farming areas. The key to success in the future development of African agriculture undoubtedly lies in the effectiveness of these training schools: to this end the department has decided to appoint an Agricultural Education Officer to be responsible for the training centres and for liaison with the Department of African Education regarding teacher training and school farm and garden policy.

75. At Monze Training Centre twenty-eight students completed satisfactorily the fourth course in May, 1953, out of thirty-six who started in October, 1951. Twenty-six students completed the first year of the fifth course and nine additional first-year students were added to this course on transfer from Katete. Twenty-two students from the southern and western areas, together with ten from the Eastern Province, started on the sixth course in October. With sixty-seven students in residence, Monze is filled to capacity and extra accommodation will be needed for the future.

At Lunzuwa twelve out of sixteen students were successful in the second course which ended in May, 1953; twenty-one students in the third course entered their second year and twenty-five new students started the first year of the fourth course.

AGRICULTURAL EDUCATION—EUROPEAN

76. In January, 1953, the department started two pupil training schemes for European youths, one for training mechanical conservation assistants at the Conservation Workshops near Lusaka, the other for training tobacco assistants on the Tobacco Station at Mazabuka near Choma. Two tobacco trainees gave up after seven months mainly because the tempo was too slow; another remains. Two mechanical trainees completed the first year of a two-year course satisfactorily. For all higher agricultural education Northern Rhodesia is dependent upon Southern Rhodesia, where three places are annually made available at Gwebi Agricultural College, or the Union of South Africa. At Gwebi, Northern Rhodesian students gave a good account of themselves finishing first, third and eighth in the first-year examination: only one student entered for the course which commenced in October, 1953.

SPECIALIST SERVICES AND EXPERIMENTAL WORK

Mount Makulu Central Agricultural Research Station

77. The following building construction was carried out during the year:

- (1) Chemistry laboratory, completed and in operation.
- (2) Plant Pathology laboratory built and in operation.
- (3) Grinding Room, Gas Plant Room and Electric Transformer Room.
- (4) Two A.K.2 houses.
- (5) One D.3 house built and nearly ready for occupation.
- (6) Foundations of Administrative Block laid.
- (7) Extensive alterations carried out to the old homestead.
- (8) Six African two-roomed houses of approved design.
- (9) Alterations to implement shed to provide two offices and two lean-to additions put on for extra storage space.
- (10) Electrical installations were completed for the time being and power from Chilanga Cement Company was laid on.
- (11) Brickmaking. All bricks required for the above buildings were made on the station. Over 500,000 bricks were made.

78. A start was made on getting together a Jersey herd and eight grade Jerseys were purchased from a Livingstone farmer. They have done very well and appear admirably suited to the local climatic conditions. Seven of the eight have calved and have produced five heifer and two bull calves. In December a further lot of twenty high-grade Jersey heifers and a pedigree bull arrived from the Quarantine Station, Mazabuka, and twenty more all Jerseys are still in quarantine. With the arrival of cattle on the station, fencing became a necessity and a start was made. To date, six paddocks have been erected varying in size from fifteen to fifty acres. Fifty acres of maize were planted in

rows six feet by nine inches and yielded 668 bags, averaging out at just over thirteen bags per acre. Eighty acres of green crops were planted, sixty of which were ploughed under in April and the remaining twenty acres made into hay.

AGRICULTURAL CHEMISTRY

79. During the year 1953, the chemical laboratories at Mount Makulu were completed and fitted out. A considerable amount of time has had to be spent in watching over the furnishing, plumbing and installation of technical fittings such as fume cupboard flues. The petrol-gas plant was assembled and put into operation by the chemist. A great many things had to be made and fitted by the chemist. The final stage has been the setting up, calibrating and putting into operation of various pieces of laboratory apparatus; the making up of a large number of reagents; the establishing and checking of various analytical methods. This stage is still in progress and will continue alongside the other work. Although these tasks have been carried out over most of the second half of the year under review, it has been found possible to examine some 100 farmers' soils in order to make fertiliser recommendations.

A large programme of field experiments was again carried through, although there were some losses due to severe weather damage. The season 1952-53 concluded the preliminary and exploratory stage of the fertiliser experimental programme, which has now been conducted for three seasons on a number of soils in the Territory. A comprehensive summary of the work that has been done on maize has now been written up, and printed as a bulletin, which was issued in December. The results of the last season generally corroborated the findings of the previous year, and the individual details are summarised below.

Eastern Province

MAIZE

80. At Petauke, a maize experiment with nitrogen, phosphate and potash had the exceptionally high average yield of 26.8 bags per acre. As might be expected, responses to fertilisers were small. However, even here there was a small, though statistically significant, response to sulphate of ammonia. Yields were as follows:

Mean yield with nitrogen applied	...	...	27.7 bags (200 lb.) grain/acre
Mean yield without nitrogen applied	...	...	25.9 bags (200 lb.) grain/acre

As in the previous year there was no response to phosphate or potash. This very fertile soil had carried groundnuts the previous year.

81. At Katete, the same experiment was again carried out on a very poor sandy soil completely contrasting with the Petauke conditions. As in the previous year there was no response to phosphate or potash, but a very strong response to nitrogen. Average yields were:

With nitrogen applied	...	...	...	8.7 bags grain/acre
Without nitrogen applied	...	...	...	4.0 bags grain/acre

Nitrogen is obviously the dominant limiting factor, but it is considered that there is a likelihood of multiple deficiencies on such soil.

GROUNDNUTS

82. The experiment testing the effects of lime, phosphate and potash was again carried out at Petauke and Katete. At Katete on poor sandveld, a considerably greater effect from phosphate was obtained than in the previous season. Average yields were as follows:

Plots receiving 200 lb. superphosphate/acre	...	1,378 lb. kernels per acre
Plots not receiving superphosphate	...	798 lb. kernels per acre

This difference was highly significant. As before there was no significant response to lime or potash. A point of interest arises here: in view of the failure of maize to respond significantly to phosphate at the same station, one is left with a possibility that the response of groundnuts to superphosphate could be due to either calcium or sulphate. Both these are supplied, along with phosphate, by superphosphate.

83. At Petauke, a similar average yield was obtained on the groundnut experiment (1,100 lb. kernels per acre), but there was no significant response to any of the fertilisers.

Southern Province

MAIZE

84. Experiments with nitrogen, phosphate and potash were laid down at the Monze and Magoye stations, and on three European farms. Serious waterlogging caused the total loss of some of these.

85. At Magoye, with maize which followed sunnhemp green manure there was a moderate response to sulphate of ammonia and a larger response to superphosphate. There was a suggestion of a small response to potash, provided that nitrogen was applied in addition, but this was not of major importance. Average yields were as follows:

No nitrogen or phosphate	...	...	...	8.5 bags grain per acre
Nitrogen applied	...	...	...	11.0 bags grain per acre
Phosphate applied	...	...	...	13.9 bags grain per acre
Nitrogen and phosphate applied	...	...	...	15.8 bags grain per acre

It will be seen that by using both nitrogen and phosphate the yield is very nearly doubled.

86. At a farm in Mazabuka a similar experiment was carried out. The experiment suffered some damage, but some information was saved. The maize followed velvet beans, and average yields were as follows:

No nitrogen or phosphate	...	...	...	2.7 bags grain per acre
Nitrogen only applied	...	...	...	4.1 bags grain per acre
Phosphate only applied	...	...	...	5.8 bags grain per acre
Nitrogen and phosphate applied	...	...	...	10.6 bags grain per acre

Under the adverse conditions of the experiment yields were very low, but the effect of the two fertilisers was outstanding. Nitrogen and phosphate were so deficient that the unfertilised yield was abnormally low, and neither of the two nutrients gave its real benefit unless the other one was also supplied.

Central Province

MAIZE

87. A number of experiments with nitrogen, phosphate and potash were laid down on several stations, and on European farms. The following figures show the effect that was obtained by side-dressing the maize with 200 lb. sulphate of ammonia per acre.

Site				Bags grain per acre	
				Without nitrogen	With nitrogen
Mount Makulu (1)	...	...	...	23.5	25.2
Mount Makulu (2)	...	...	...	18.3	22.5
Mount Makulu (3)	...	...	...	13.3	16.7
Chalimbana	...	...	...	6.0	8.5
Mukalaikwa	...	...	...	17.2	19.0
Keembe (1)	...	...	...	11.6	12.6
Keembe (2)	...	...	...	12.9	16.9
C. Rickett's farm	...	...	...	10.3	14.0
Mr. Randall's farm	...	...	...	10.3	12.8
Col. Yates' farm	...	...	...	11.0	17.4
R. H. Howard's farm	...	...	...	11.1	13.2

The first experiment at Keembe had an inadequate final stand of plants (only about 4,600 per acre), and this accounted for the small response.

88. In a further small experiment at Colonel Yates' farm interesting comparisons between times of application of nitrogen and varieties of maize were obtained:

Time of applying nitrogen				Yield of grain in bags per acre	
				Hickory King	S.R. Hybrid
Nil...	...	...	...	7.6	6.5
At planting	...	...	...	11.8	13.1
Six weeks after planting	...	...	...	13.9	13.0
Nine weeks after planting	...	...	...	8.0	12.5

The following yield figures illustrate the effect obtained by applying 200 lb. per acre of superphosphate to maize at planting:

Site				Yield of grain as bags per acre	
				Without phosphate	With phosphate
Mount Makulu (1)	...	...	...	23.5	25.2
Mount Makulu (2)	...	...	...	12.8	17.2
Mount Makulu (3)	...	...	...	13.1	16.4
Chalimbana	...	...	...	7.3	9.2
Mukalaikwa	...	...	...	16.7	19.5
Keembe	...	...	...	11.9	12.4
C. Rickett's farm	...	...	...	12.2	12.2
Mr. Randall's farm	...	...	...	10.9	12.2
Col. Yates' farm	...	...	...	13.8	14.6
R. H. Howard's farm	...	...	...	11.3	13.0

89. In three experiments sited at Chalimbana, Keembe and Mount Makulu, the effect of small amounts of nitrogen and potash at planting, such as the proprietary mixtures " B " and " D ", was investigated. The results so far do not provide any evidence that the mixtures are any better than straight phosphate. Investigations into this question are continuing.

SORGHUM

90. Two experiments on sorghum were conducted at Serenje, on very poor sandy soil. The results are not conclusive and need further investigation. The first experiment tested the effects of superphosphate (200 lb. per acre) and muriate of potash (100 lb. per acre) applied at planting time, and the sulphate of ammonia (200 lb. per acre) applied as a side-dressing six weeks after planting. No significant effects were obtained.

91. The other experiment tested nitrogen and phosphate, together with different times of application of nitrogen. The latter was applied at planting time; at six weeks after planting; and thirdly as a split application, half at planting time and the other half six weeks later. In this experiment a significant though small response was obtained with nitrogen.

With 200 lb./acre sulphate of ammonia	...	1,446 lb. grain per acre
Without sulphate of ammonia	...	1,154 lb. grain per acre

There was no response to phosphate, and the difference between times of application of nitrogen did not reach significance. It was noted, however, that there was a definite indication that the application of sulphate of ammonia was (unlike maize) better at planting time than six weeks later.

It is possible that, this being so, a hint of a nitrogen effect in the first experiment would have been turned into a real effect if the sulphate of ammonia had been applied at a different time. In the second experiment there was a significant interaction between nitrogen and phosphate, with an indication that phosphate might become of significance if nitrogen were also applied.

On this poor soil the average yield of sorghum on the experiments was low—6.5 bags an acre—and this, together with the poor responses, might suggest a multiple deficiency.

Soil Survey

92. The Soil Scientist spent the months of March to September in Nyasaland working under Dr. Muir on the soil survey of the Shire Valley. A great deal of knowledge and experience as to rapid soil survey reconnaissance technique was acquired.

93. A reconnaissance survey of some forty-five square miles of the Zambezi Valley near Chirundu was completed, using the maps and photographs of the area supplied by the Air Survey Company of Rhodesia, Salisbury. The results were disappointing in many ways, for examination revealed a scarcity of soil suited for a sugar cane plantation particularly in the block of 3,000–5,000 acres desired. The area where cane is at present being tried on a pilot scheme basis is capable of extension to approximately 1,200 acres. Surrounding this is a ring of unsuitable land, either covered with mopani forest or in which gravels and rock are either shallow or exposed at the surface. The most suitable land in a continuous block is the delta at the mouth of the Lusito River, which is of a soil type fairly similar to the one on which cane is already being grown. However, this area is cultivated for subsistence crops by African villagers living nearby.

94. Soil samples were taken from all the main soil types, examined, and these are now being analysed in the laboratory. There are apparently three main soils:

- (1) A light sandy river terrace soil such as occurs to a large extent in the area of the pilot scheme.
- (2) A coarser sandy soil derived from sandstone. This varies considerably in thickness and is very poorly provided with nutrients owing to its great depth variability and the undulating country in which it occurs; it appears unsuitable to large-scale irrigation. However, within these two soil types there does not, at the moment, appear to be any danger of salinity.
- (3) The third main soil type is one characterised by excessive accumulation of salts within the profile, and it is these soils which are being subjected to an intense laboratory analysis.

95. From vegetational and soil morphological characteristics certain areas of soil appear quite unsuitable for agricultural purposes, merely from inspection, i.e., large areas of extensively eroded grassland and tracts of mopani forest. However, the areas in which extensive panning occurs but which fail to show field evidence of unsuitability have now had conductivities, pHs and mechanical analysis completed on the samples collected. In many cases pHs jump from 8.5 in the top five inches to over 10 in the next five inches, rising progressively to a depth of approximately thirty-six inches and then slowly falling again, although in all cases remaining over 10. Extremely high conductivities indicate considerable accumulation of salts, and this taken in conjunction with the pH probably means the presence of a sodium salt: this is being investigated in the laboratory.

A report was completed on a short survey in the east end of the Kafue Flats. The indications were not encouraging from the point of view of irrigation.

Plant Pathology

96. During the first six months of the year an attempt was made to assess the relative importance of the numerous plant disease problems in the Territory. The principal European and several of the African farming areas were visited in this connection. Tobacco, rice and groundnuts would appear to be the crops warranting most attention at this stage. The co-operation of Provincial Officers is assisting materially in forming a comprehensive picture of the plant disease situation in the Territory. Two hundred and five (205) specimens were received for diagnosis during the year. These have served the useful purpose of bringing hitherto unrecorded diseases to light and will help in the compilation of a disease list for the Territory.

97. Anthracnose (*Colletotrichum tabacum* Boning) caused severe damage to tobacco seedbeds in the Choma–Kalomo area during the 1952 and 1953 seedbed seasons. Spraying with copper fungicides although temporarily checking the disease is not an adequate control measure. Research is proceeding with the epidemiology of the fungus in relation to possible measures for control. A disturbing feature of the disease in 1953 was its persistence on tobacco in the field, a feature absent in the 1952 season.

98. Boron deficiency causing bud degeneration in tobacco was noticed on several farms in the Fort Jameson area.

99. Maize Rust (*Puccinia polysora* Underw.) was recorded for the first time in 1953. Representatives of the two Rhodesias, Nyasaland and the Union of South Africa met in Salisbury to consider what action was to be taken to meet a possible threat to the maize industry from this fungus. It was decided that as many strains of maize as possible be collected and exposed to infection in each of the territories where the disease has been recorded so that resistant lines, if any, can be selected and developed.

100. In trials of summer wheat from Kenya many varieties were severely attacked by Leaf Rust (*Puccinia triticina* Eriks.). Black Stem Rust (*Puccinia graminis* Pers.) was found on only a few varieties and was not serious.

101. At the Mumbwa Pilot Groundnut Scheme, Rosette disease and Leafspot (*Cercospora arachidicola* Hori) resulted in almost total failure of the crop. Poor stands apparently accentuated the damage caused by Rosette disease.

102. Die-back in a lime orchard was considered to be due to general malnutrition and in particular to zinc deficiency. No evidence of virus infection was noted.

103. Investigations were begun to determine the effectiveness and economics of pre-emergence spraying of maize with two 4D compounds to control weed growth. Results are not yet available. Messrs. African Explosives assisted in these trials by sending a technical representative in an advisory capacity earlier in the year. The 2,4,5,T brushkiller is being tested for the control of *Lantana camara* L., the growth of which is assuming serious proportions on grazing land in some localities.

Pasture and Related Problems

104. A herbarium was started with 175 local collections. Seventy-five pasture and fodder species were introduced from other African territories and Australia, and a plant introduction register was opened to keep track of these and future introduced material. Twelve acres of good Upper Valley soil at Mount Makulu Research Station was ploughed and cultivated in the winter to eradicate *Cynodon dactylon* and will come into use in 1954 as the site of observation, bulking and test plots for indigenous and introduced species.

Irrigation

105. *Kafue Flats*. Observations were continued on conditions on the flats at different seasons of the year and over a wide range of country. The possibility of establishing experimental plots to solve agricultural problems on the flats had been borne in mind, but it has not yet been possible to make the final decision as to its site.

106. *Chalimbana Valley Irrigation Project*. The original proposal was to build a dam high up the river, designed to hold some 6,000 acre-feet. The line for the proposed canal from this dam was pegged and the agricultural possibilities of the controlled area were examined. There was, however, some doubt as to whether this dam would fill in a dry year so at the request of the local Intensive Conservation Area Committee a site further downstream was investigated. The storage capacity of the latter is less than half that of the former but the inflow is much more satisfactory. The irrigation areas below this dam have recently been photographed from the air and detailed contour maps will soon be ready. With the aid of these it will be possible to investigate the extent and nature of the soils that will be commanded by the various possible canals arising from the dam.

107. *Kaleya Project*. The area proposed for this scheme has been photographed from the air and detailed examination of the irrigable areas now awaits the arrival of the aerial contour maps.

Tobacco

108. Investigations were continued on many aspects of tobacco growing, curing and handling. A brief outline of the principal results is given.

SEEDBEDS: WATERING BY CAPILLARY ACTION

109. Capillary beds filled with soil were far superior to standard pattern beds which received overhead watering, and these in turn were better than capillary beds filled with vermiculite. The seedlings in the soil capillary beds looked healthier than the others and growth was definitely more rapid. Before being able to recommend the construction of this type of bed for use on farms, it remains to prove that the seedlings produced in them stand up to field conditions better than do seedlings from standard pattern beds. This phase of the experiment should be completed by the end of the 1953-54 season.

USE OF VERMICULITE INSTEAD OF SOIL

110. The growth of seedlings was retarded in comparison with seedlings grown in soil whether in standard beds or capillary beds, and there was a marked tendency for the production of excessively long tap-roots. The fibrous root system, however, was very much more developed than in seedlings grown in soil. The cost of preparing the beds of the vermiculite and plant nutrients has proved uneconomical for the time being.

CHEESE-CLOTH VERSUS GRASS COVERS

111. Beds covered with cheese cloth have produced more robust seedlings than were obtained from beds covered with combed grass; the growth was more uniform and the seedlings were ready for transplanting several days earlier.

STERILISATION OF SEEDBED SOIL BY FLAME-THROWER

112. In a search for a more economical and labour-saving method of soil sterilisation than by burning or steaming, a detailed study was made of the effects of sterilising seedbed soil by the aid of a flame-thrower. The experiment consisted of comparing the effects and costs of using a Sears Roebuck Cross Country Burner against burning with brushwood.

113. In the beds sterilised by burning brushwood, a potato buried in the soil at a depth of three inches was thoroughly cooked. In a similar test, a potato buried three inches under the soil was hardly warm when the flame of the burner had been playing on the surface of the soil immediately above the potato for twenty minutes. The potato was raised to within one and a half inches of the soil surface and at this depth it became hot but was not cooked. Although the temperature of the flame is claimed to be 2,000 degrees, the indication is that though it may sterilise the surface the depth of heat penetration is limited to about half an inch.

114. No noticeable difference was observed between the two treatments as far as the growth of weeds in the seedbeds was concerned.

115. On beds on which the flame-thrower had been used *Colletotrichum tabacum* Boning appeared thirty-three days after sowing and was not easily brought under control. This disease was not apparent in beds sterilised by burning brushwood. A second outbreak of the disease appeared twenty-two days later in the flame-thrower beds while the brushwood beds remained normal and healthy.

116. Plants from both series were planted alongside each other in a field and there was no noticeable difference between them throughout the period of growth.

117. The costs of the two methods were practically the same but there was a distinct saving in labour by using the flame-thrower.

118. It was concluded that the Roebuck Cross Country burner is not adaptable for sterilising a tobacco seedbed site.

FERTILISER EXPERIMENT

(a) *On virgin light-bodied coarse sandy soil (Mochipapa)*

119. In the wet and very overcast season of 1951-52 it appeared that there was a real advantage in yield per acre from a heavy application of 600 lb. of Tobacco "A" fertiliser as compared with 350 lb. and 200 lb. In 1952-53 on the other hand when rainfall was again above normal but there were periods of sunshine, there was no apparent advantage in using more than 200 lb. Tobacco "A" mixture. There was no significant difference in quality as a result of the various rates of application although there was an indication that the higher rates were better.

Treatment				Yield of Cured Leaf (lb./acre)	
				1951/52	1952/53
Nil—control	...	...	...	496	452
200 lb. "A"	...	...	...	860	982
350 lb. "A"	...	...	...	816	914
600 lb. "A"	...	...	...	996	915

(b) *On virgin pinkish-brown sandy loam (Msekera)*

120. Again as in the previous year the yield per acre was significantly increased by applying 600 lb. "A" mixture per acre as compared with 350 and 200 lb. respectively. There was no advantage in using 350 lb. as compared with 200 lb. As far as quality goes there was no significant difference between the treatments.

Treatment				Yield of Cured Leaf (lb./acre)	
				1951/52	1952/53
Nil—control	...	...	...	416	537
200 lb. "A"	...	...	...	800	743
350 lb. "A"	...	...	...	796	953
600 lb. "A"	...	...	...	992	1,146

(c) *On second-year light-bodied coarse sandy soil (Mochipapa)*

121. The yield per acre and the cash return increased in direct proportion to the increase in the rate of application of the tobacco fertiliser "A" mixture. There was an indication that the moderate application, i.e., 350 lb. "A" per acre gave the best quality.

(d) *On second-year pinkish-brown sandy loam (Msekera)*

122. There were no significant differences between the various treatments except in so far as the heaviest application, i.e., of 600 lb./acre of "A" mixture seemed to cause a high incidence of white mould which resulted in considerable low-grade leaf and consequently less cash return.

FERTILISERS VARYING IN COMPOSITION

123. The experiment was designed to find a fertiliser which is really suited to conditions pertaining in Northern Rhodesia. When the experiment was commenced in 1951-52 farmers had the choice of only two fertiliser mixtures for the tobacco crop—mixtures "A" and "B"—and the general consensus of opinion was that neither was really ideal for local conditions.

124. In this experiment mixtures approximating "A" and "B" in analysis are incorporated for comparison with seven other mixtures, one of which, as it transpires, is almost identical with mixture "C" which has come onto the market since the inception of the experiment. The treatments tested were:

Treatment	Approximating Mixture					N	P ₂ O ₅	K ₂ O
O — Nil	...	...	...	...	...	Nil	Nil	Nil
P — 6 : 10 : 9	...	...	A	...	...	6	10	9
Q — 3 : 13 : 9	...	...	B	...	...	3	13	9
R — 6 : 13 : 3	...	...	...	...	...	6	13	3
S — 10½ : 7½ : 6	...	...	...	...	...	10.5	7.5	6
T — 8½ : 8½ : 9	...	...	...	...	...	8.5	8.5	9
U — 9½ : 7½ : 9	...	...	...	...	...	9.5	7.5	9
V — 10½ : 6½ : 9	...	...	...	...	...	10.5	6.5	9
W — 7 : 18 : 12	...	...	C	...	...	7	18	12
X — 5 : 9½ : 15	...	...	...	...	...	5	9.5	15

125. The fertiliser mixtures were applied at the rate of 150 lb. per acre before planting, 100 lb. per acre three to four weeks after planting and 100 lb. per acre approximately three weeks later. The total application was at the rate of 350 lb. per acre and the method of application was by hand in a circle around the stem of the plant, the fertiliser being worked into the soil by hoeing. Results:

(a) *On virgin light-bodied coarse sandy soil (Mochipapa)*

Obviously no final conclusion can be arrived at after experimentation over two seasons only, but it would appear that treatments P (6 : 10 : 9) and V ($10\frac{1}{2}$: $6\frac{1}{2}$: 9) are promising, while treatment W (7 : 18 : 12) has shown up well during both seasons in relation to yield and cash return. As the analysis shows, treatment W is akin to standard tobacco "C" mixture (6 : 18 : 12) and P approximates standard tobacco "A" mixture.

(b) *On virgin pinkish-brown sandy loam (Msekera)*

Whilst certain treatments in one out of the two years may have done better, the two which have been consistently good over both seasons in regard to all three factors of yield, quality and cash return are W (7 : 18 : 12) and P (6 : 10 : 9).

METHODS OF APPLICATION AND EQUIPMENT

126. Based purely on observations made in the field there was no difference in the standard of growth between plants which had been fertilised by hand (ring method), by Stokes Gun, or by Kestrel Gun. In the case where the fertiliser was broadcast before planting the tobacco was more advanced to begin with but later tended to lag behind.

VARIETY TRIALS

127. As far as disease is concerned, and with particular reference to *Alternaria*, there was no difference in degree of resistance or susceptibility between varieties.

(a) *On virgin light-bodied coarse-grained sandy soil (Mochipapa)*

In the seasons 1951-52 and 1952-53 the highest yields per acre were obtained from "Willow Leaf" and "White Stem Orinoco". "Jamaica Wrapper" proved very disappointing. These findings are rather surprising because in Southern Rhodesia "Willow Leaf" is regarded as more suitable for the better quality sandy soils while "Jamaica Wrapper" is considered the ideal variety for the poor type of soil on which this experiment was conducted. As regards quality, based on the 1952-53 crop, "Willow Leaf" and "White Stem Orinoco" were well to the fore, but of the two "Willow Leaf" was slightly the better. "Jamaica Wrapper" and "Yellow Mammoth" were both disappointing.

(b) *On the second-year light-bodied coarse-grained sandy soil (Mochipapa)*

Conflicting results have been obtained over the two seasons. In 1951-52 "Yellow Mammoth", "C/7", "Jamaica Wrapper" and "Gold Dollar" proved the highest yielding varieties. In 1952-53 "Willow Leaf" and "C/10" topped the list with "C/7", "Bonanza", "Duquesne" and "Jamaica Wrapper" all above average. "Warne" and "Delcrest" were most disappointing.

ROTATION OF CROPS

128. A trial consisting of two replications of four different eight-course rotations begun in 1949-50 is being conducted on the Mochipapa Station. The soil is of such a poor level of fertility that sorghums are being grown instead of maize. Tobacco was not due to be grown until 1953-54.

EELWORM EXPERIMENTS

129. Much work is required before a complete answer to this problem will be forthcoming. In the meantime it can be reported that for the eradication of eelworm in the field satisfactory results have been obtained by the application of ethylene dibromide (W.85) at 3 c.c. per planting station and D-D soil fumigant at the rate of 8 c.c. per planting station.

130. Also tobacco planted in soil which is infested with eelworm can be boosted to produce an economic yield by the application of well-rotted compost or screened kraal manure.

Machinery Trials

131. In addition to the trials of gadgets used in connection with tobacco planting and a grass planter mentioned elsewhere in this report, the department acquired a No. 24 International maize picker for demonstration purposes. This is a two-row picker that is mounted on a suitable tractor. No special preparation was made in the way of planting or spacing the demonstration crop. Despite the fact that the land was very weedy the machine did a very good job with a twelve-bag-per-acre crop, picking the cobs with the husks left on. On this last point the machine can be used to pick with or without the husks but in this trial it was found that picking clean without the husks was inclined to strip rather too much grain off the cobs. Unfortunately a bearing seized on one of the main roller shafts and as there were no spares in Southern Africa the new part had to be ordered from America. It is hoped to have the machine ready for further and more careful trials next season when it should be possible to obtain figures of the relative costs of machine and hand reaping. The indications were, however, most encouraging.

Notes on trials on District Stations and Seed Farms

132. Agricultural Officers carried out a large number of trials on a wide range of local problems on base stations and seed farms throughout the Territory. The following is a very brief summary of some results of general interest.

CENTRAL PROVINCE

133. In a trial at Serenje, selected local strains of kaffir corn (sorghum) yielded at the average rate of 901 lb. per acre as compared with only 408 lb. per acre from imported dwarf varieties.

134. Trials of beans at various centres gave the usual uneven and unpredictable results which may be indicated as follows:

		Yield in 16/acre			
Station		Canadian Wonder		Soya Bean	Velvet Bean
Serenje	...	...	230	514	—
Muswishi	...	...	382	600	—
Keembe	...	...	100	0	4,000

135. Groundnuts were attacked by Rosette disease at Chalimbana and failed completely. At other stations the largest yield recorded was 324 lb. per acre of a local variety as compared with 313 lb. per acre Natal Common.

136. Safflower was tried under relatively good conditions but again the yield was very poor—40 lb. per acre.

137. Sunnhemp gave the following results as a seed crop:

Serenje	...	...	...	330 lb. per acre
Chiweuwe	...	...	...	1,012 lb. per acre
Muswishi	...	...	...	337 lb. per acre

At Keembe severe lodging was caused by the disease *Colletotrichum* sp.

138. A grass-planting machine was tried on a twenty-acre field at Chalimbana using Star Grass. The machine was found to be most unsatisfactory: it tended to become jammed and the grass runners were either buried completely or left high and dry on the surface. It was concluded that the machine might be suitable under ideal conditions in the United States but not in Northern Rhodesia at present.

EASTERN PROVINCE

139. Some interesting points emerged from trials with cotton in the North Luangwa which have been carried out over a period of three years. Within the past year yields from different times of planting ranged from 877 lb. down to 646 lb. seed cotton per acre demonstrating and confirming the previous year's results that early planting (i.e., in December) gives significantly larger yields. Rainfall was only twenty-one inches. Stainer damage ranged from 36 per cent. to 45 per cent. per plot and there was no significant difference between three times of picking. On the basis of three years' experience there appeared to be some correlation between total rainfall and the incidence of stainers: this is illustrated in the following figures:

1951	Rainfall 29 inches:	average stained cotton	23 per cent.
1952	Rainfall 34 inches:	average stained cotton	18 per cent.
1953	Rainfall 31 inches:	average stained cotton	40 per cent.

140. A spacing trial with different varieties of rice gave results suggesting that the earlier maturing varieties, e.g., Burma, Tanganyika and Demerara Creole, benefited from the closer spacing at six inches by six inches whereas later varieties gave higher yields at six inches by nine inches spacing. The very latest varieties, e.g., Kota Kota which normally takes 210 days, did not appear to be affected by the spacing. The varieties Afaa Mwanga (3,600 lb.) and Demerara Creole (3,320 lb.) gave the highest average yields per acre while Kota Kota and Demerara Creole were the best of fourteen varieties for quality, i.e., long white translucent grains giving a high out-turn of No. 1 grade rice.

141. Mercurial dust treatment of groundnut seed gave a better stand and healthier-looking crop.

WESTERN PROVINCE

142. In a pig feeding trial at Kambowa pigs made an average gain of 10 lb. per week from weaning to marketing at 120 lb. live weight with a food conversion rate of 3.5 lb. meal for 1 lb. live weight increase.

143. Also at Kambowa a great deal of valuable experimental work was continued on a wide range of sub-tropical and temperate fruit and vegetable crops. A wealth of scientific data is carefully being compiled but it would be premature to comment on the results at this stage.

143. At the small demonstration farm at Samfya trials were continued of possible rotations to suit local conditions as a preliminary to any extension of African peasant farming to this area. Careful costings were made and will continue to be made in relation to crop-production data over the whole period of the rotations.

BAROTSELAND

144. At Namushakende the season was favourable for rice experiments. The total area of plots was 16.855 acres from which 33,914 lb. paddy was harvested, i.e., an average yield of 2,014 lb. paddy per acre. Angola No. 6 was the best variety in small experimental plots, the yield being at the rate of 4,866 lb. paddy per acre. But in the field scale plots, Tanganyika Faya was best with a yield of 3,864 lb. paddy per acre.

145. In a trial of parboiling using a simple locally made boiler, it was found that twenty-four hours' soaking and parboiling for one hour gave good results. The taste and colour on cooking were excellent but in the raw state the rice had a slightly yellow colour which it has not yet been possible to eliminate.

146. Jaggery from sugar cane is something quite new in Barotseland and trials that have continued over the past three years were brought to a successful conclusion. Difficulty in clarifying the price was overcome through the use of lime together with the bark of a local tree called *Grewia Rautenii*. It was found that 58 lb. jaggery could be obtained from 1,000 lb. sugar cane at a cost of 5.06d. per lb. of jaggery.

PILOT SCHEMES

Rice Production

147. Continued attention has been given to encouraging rice production particularly in Barotseland, in parts of the Eastern Province, and in the Bangweulu-Luapula District of the Northern Province. In Barotseland the industry has had a set-back because the quality of the rice produced is acceptable to only a small section of the population at an uneconomic price. After careful consideration it has been decided to lower the producer price of paddy from 2½d. to 1½d. per lb., to introduce seed of a longer-grained high quality Kota Kota rice, and to build up more efficient processing units. If these efforts are successful it is hoped to be able to increase the producer price to stimulate production again.

148. In the Eastern Province the Petauke Co-operative Marketing Union continues to produce a good product, and considerable quantities of seed of the varieties Kota Kota, Faya and Demerara Creole have been distributed. Groundnuts and maize production compete for labour with rice production at present prices.

149. In Bangweulu-Luapula experimentation and extension work continues and sound foundations for an industry are being laid. Although the total crop purchased by the Bangweulu Marketing Union was less than in the previous year this was due mainly to political disturbance.

Oil Palms

150. Work was continued according to plan. At Mulwe where the establishment of three three-acre pollen parent plots was begun in November, 1952, further transplanting was continued in February and November/December, 1953, when the position was as follows:

Local seedlings 189, Nigerian Dura 57, Nigerian Tenera 136.

The rate of survival worked out at 81 per cent. which compared most favourably with a standard of 60 per cent. in Nigeria. Experience has shown that whereas in Nigeria transplanting is recommended to be done on a cloudy day in inclement weather, under our conditions at Lake Mweru it is important to plant as soon as possible after the commencement of the rains.

151. The selection and recording of 100 phonotypes was begun in the Mulwe area in June. The recording of trees on Kilwa Island which was begun in 1952 was delayed owing to lack of transport facilities on the lake.

152. At Mubende also 100 trees were selected and a start made on recording them in July (after a false start in June due to the African Assistant concerned becoming scared to climb forty-foot high trees!) Here, too, an experimental irrigated plantation of three acres was established.

153. In the southern section of the area the census of trees was completed. From Munangu to Johnstone Falls there were 1,807 palms of which 1,035 are bearing (the figure does not include 191 bearing palms at Mubende).

154. Four more bulk analyses of oil palm fruit were carried out during the year. The average pericarp percentage worked out at 46.7 per cent. which was slightly over the requisite for hand processing but the total quantity was not sufficient to warrant setting up a hand press at this stage.

Pilot Groundnut Scheme

155. The diseases "Rosette" and "Leaf Spot", which caused the almost total failure of the crop in the second season, appeared again in epidemic form and caused the total failure of the groundnuts in this third season. The entire acreage of 400 acres of groundnuts became so severely attacked by both diseases that the vines turned black and died long before harvesting time with the result that the crop could not have been lifted mechanically owing to the absence of haulms assuming there had been any crop to lift.

156. It was a disappointing, if not altogether surprising, outcome of a pilot scheme that has cost some £50,000, but at least it can be said that a clear-cut answer has been obtained albeit a negative one. At the same time some useful information was obtained, for example it was clearly demonstrated during the first year that groundnut production can be mechanised with but little difficulty and at considerable expense. Also the other lines that go towards the evolution of a sustained production system have been quite successful, e.g., maize, Rhodes grass, sunnhemp and cattle. A full report on the three seasons' operations was submitted to Government, together with the recommendation that the scheme should be continued for at least the balance of the five-year period on a modified scale on experimental lines, so as to investigate the diseases of groundnuts and to follow up the possibility of devising a system of land-use that would be useful in connection with African agricultural extension in the neighbouring native reserve and trust land. This recommendation was accepted and the modified programme was put in hand with the onset of the rains towards the end of the year.

Sugar Cane

157. The Gwembe Pilot Sugar Scheme got off to a good start early in the year. Later, however, labour and mechanisation difficulties interfered with the rate of progress. By July some 250 acres of the pilot scheme had been surveyed and levels taken. Ploughing was progressing very favourably but unfortunately the tractor broke down very badly and it took over three months to obtain spare

parts and to get it working again. Another difficulty arose over the irrigation equipment for which the piping was not delivered until late November so that planting was of necessity held over until the start of the rains. Then again, the rains came very late and irrigation had to be employed to some extent for planting. To make matters worse the labour situation deteriorated during the busiest time. The total labour strength during December was only twenty-seven men and five women, which was totally inadequate to cope with weeding and irrigating the existing thirty acres of cane while carrying out further planting. Nevertheless a total of nearly 100 acres of sugar cane was established by the end of the year, a little less than the target figure. Observations on the earliest planted sugar cane (more than a year old) showed that growth was excellent (eight feet to ten feet) in the low places but on the slopes and high spots growth was severely stunted possibly because of the difficulty of providing adequate water or for some other reason. Observations on this last point must be continued to make sure exactly what the trouble is because as it stands at present there could be no justification for contemplating further development on the present lines.

LEGISLATION

158. The following Ordinances were enacted during the year:

- No. 2 of 1953—The Tobacco Marketing and Levy (Amendment) Ordinance.
- No. 4 of 1953—The Tobacco (Export, Sales by Auction and Compulsory Pooling of the Proceeds of the Sales of Tobacco) (Repeal) Ordinance.
- No. 35 of 1953—The Land Bank (Amendment) Ordinance.
- No. 37 of 1953—The Fencing Amendment Ordinance.
- No. 39 of 1953—The Farmers' Licensing (Amendment) Ordinance.
- No. 59 of 1953—The Noxious Weeds Ordinance.

The following *Gazette* Notices affecting the department were published:

- General Notice 234—Intensive Conservation Area—Chilanga.
- General Notice 837—Intensive Conservation Area—Choma, North and South.
- General Notice 416—Intensive Conservation Area—Karubwe.
- General Notice 1670—Intensive Conservation Area—Mkushi and Mlembo.
- General Notices 218 and 299—Intensive Conservation Area—Mwomboshi.
- General Notice 931—Intensive Conservation Area—Nega Nega.
- General Notices 1252 and 1706—Intensive Conservation Area—Pemba.
- General Notices 693, 1487 and 1596—Natural Resources Board.
- General Notice 265—Tobacco Marketing and Levy Ordinance (Tobacco Levy—Eastern Area).
- General Notice 169—Groundnuts Prices Order, 1953.
- General Notice 155—Plant Pests and Diseases Ordinance—Importation of Plants (Amendment) Regulations, 1953.
- General Notice 668—Board of African Agriculture.
- General Notice 644—Eastern Province Maize Pool.
- General Notice 1418—Fertilisers, Subsidisation of, for Maize Growing.
- General Notices 1266 and 989—Maize: Producer price of.
- General Notice 1198—Wheat: Producer price of.
- General Notice 1563—Control of Bush Fires and Trespass Ordinance. Fire Boards: Lower Kaleya.
- General Notice 1562—Control of Bush Fires and Trespass Ordinance. Fire Boards: Mazabuka.
- General Notice 1565—Control of Bush Fires and Trespass Ordinance. Fire Boards: Nega Nega.
- General Notice 1564—Control of Bush Fires and Trespass Ordinance. Fire Boards: Upper Kaleya.
- General Notice 1566—Control of Bush Fires and Trespass Ordinance. Fire Boards: Magoye/Monze.
- General Notice 993—Commission of Inquiry Ordinance. Commission to Inquire into European Farming Industry.
- General Notice 1031—Itinerary of Commission to Inquire into the European Farming Industry
- General Notice 1419—Cowpeas. Native. Revocation of Regulations Controlling Purchase and Sale.
- General Notice 861—Eastern Province Agricultural Produce Ordinance. Producer price of maize.
- General Notice 1268—Grain Bags and Pockets.
- General Notice 506—Grazing on Crown Lands.
- General Notice 805—Groundnuts. Locally grown supplies on sale.

PUBLICATIONS AND PUBLICITY

159. A series of African Broadcast Talks were arranged throughout the year.

One departmental Bulletin was published: No. 7—"Maize Fertiliser Experiments in Northern Rhodesia, 1950-1953". By E. Pawson, B.Sc. (HONS.) (LOND.), F.R.I.C.

VISITORS

160. The department received visits from the following during the year:

Mr. W. L. Gorell Barnes, C.M.G., Colonial Office.

Major N. E. Brooks, Secretary for Agriculture, Southern Rhodesia.

Mr. R. McChlery, Director of Research and Specialist Services, Southern Rhodesia.

Mr. C. A. Murray, Director of Conservation and Extension, Southern Rhodesia.

Dr. V. M. Wadsworth, Chief Agricultural Economist, Southern Rhodesia.

Mr. P. Gordon Deedes, Chairman, Natural Resources Board, Southern Rhodesia.

Major G. C. Cameron, O.B.E., Chairman, Southern Rhodesia Cotton Research and Industry Board.

Mr. J. E. Mayne, Colonial Office.

Mr. L. T. Tracey, Southern Rhodesia.

Mr. Philip Mason, Royal Institute of International Affairs.

Dr. D. Meredith, African Explosives, Johannesburg.

Dr. E. R. Hatingh, African Explosives, Johannesburg.

IN CONCLUSION

The year has been interesting and exacting making many additional calls upon the department at all levels. I would like to pay tribute to the patience and loyalty of all members of the staff, European and African, which have enabled good progress to be made in the year under review.

3rd March, 1954.

C. W. LYNN,
Director of Agriculture.

